West Virginia Watershed Assessment Pilot Project
Gauley, Upper Guyandotte, and Little Kanawha Watersheds
First Expert Workshop Summary
October 10-11, 2012
Bridgeport, West Virginia

Workshop Objectives

The goals of this workshop were to:
1) present the recently developed objective method of watershed classification and obtain experts' opinions and suggestions;
2) present the results of the condition assessments for the final three of five pilot watersheds: the Gauley, Upper Guyandotte, and Little Kanawha, and request feedback from the experts on any knowledge of issues in these watersheds; and
3) request expert feedback on desirable features for the interactive web tool that will be developed for the assessment.

Workshop Day 1
October 10, 2012

Presentation Summary

The workshop began with a review of the project goals and timeline, as well as a brief review of the watershed assessment structure: landscapes, indices, and metrics. The team then presented the new objective method of classifying the results, followed by reports on the assessment results for the Upper Guyandotte and Gauley watersheds. An open discussion followed each presentation, during which experts who had not attended previous workshops requested further information, and experts familiar with the project offered suggestions and additional questions. Overview maps of the Upper Guyandotte and Gauley watersheds were displayed for reference. After the watershed presentations, the Team's final list of metrics and weights was reviewed with the experts.

Objective Methodology

Ruth Thornton, TNC

Ruth presented the project background and a summary of the methodology. A particular emphasis was the presentation of the objective ranking of planning units, for which the Team used the DEP's Reference and Stressed catchments to determine the values for all metrics in the three models. This resulted in the establishment of thresholds to place planning units into four objective categories: Very Good, Good, Fair, and Poor.

A list of metrics and the objective thresholds used was provided to the experts. Handouts showing results maps for the Little Kanawha watershed illustrated the differences between the objective and relative

methods of classification, which ranks each HUC-12 or NHDPlus catchment relative to the others within the HUC-8 watershed.

Overview of Upper Guyandotte Watershed Results

Diane Packett, TNC

There is a large amount of active and legacy surface mining, as well as underground mining, in the Upper Guyandotte watershed, especially in the northwest and southeast areas. There are many wells, but little concentrated development except in the Logan area. Most of the major tributaries of the Guyandotte River are impaired. There are GAP 2 & 3 Protected Lands, including several WMAs and one state park.

Comments: Experts noted that the Coal Field Expressway and King Coal Highways are currently under construction and can be added to the Consolidated Analysis. An expert also suggested the possibility of including the Hatfield – McCoy ATV trails.

Overview of Gauley Watershed Results

Misty Downing, TNC

The Gauley watershed is notable for a large area of undeveloped Wilderness Area, and the large Meadow River wetland complex in the southern portion. There is some surface and underground mining, and gas development occurs in the northwestern portion of the watershed. Experts noted that acid precipitation is a current and future threat to the unbuffered soils, especially in the Cranberry Wilderness.

Metrics and Weighting: Discussion Summary

Ruth Thornton, TNC

After introducing the first two watersheds, the team reviewed with the experts the final list of metrics used for each condition index for each of the three landscape models (Streams, Wetlands, and Uplands) along with their weights in the assessment. Experts were provided with a list of metrics that were dropped from, and retained in, the analysis (based on expert opinion, correlation, regression, and Principal Components Analysis).

TNC then facilitated a breakout session with two groups to discuss the metrics, thresholds, weighting, and categorization methods. Specific questions that participants were asked to consider were:

- Are thresholds defined appropriately?
    - Is the Very Good/Good threshold too stringent? Very difficult to attain.
    - Is the Poor/Fair threshold too stringent?
    - Should an alternate definition (i.e., quantiles, other?) be used where thresholds don't work?
- How should metrics with missing thresholds be handled?
    - Keep as presence/absence
    - Assign intermediate very good/good and poor/fair categories instead of forcing into good and fair only
    - Assign arbitrary/"best guess" thresholds for all thresholds

The feedback and recommendations from the experts during the roundtable discussion and breakout session are summarized by topic in the following sections.

Landscapes and Indices

Streams Water Quality Index. The experts had a number of opinions on the weighting of the land cover metrics used in the calculation of the Streams indices.

- The "positive" and "negative" landscape metrics do not necessarily have to be weighted equally; for example, 1 acre of urban development has a far more negative impact on stream quality and function than 1 acre of natural cover has a positive impact.
- Much of the land conversion in West Virginia occurs in the riparian zone, so the weight of the riparian metrics should reflect that in some indices they are more important to stream quality than catchment-scale land cover.
- Upland conversion affects streams only within 300' of stream so that the riparian buffer captures all of the upland area that is necessary for stream health.
- Riparian land condition is always the driving factor in stream health except in the cases of mining and urbanization.
- Perhaps weight the riparian land cover higher than the catchment-scale land cover (i.e. 0.75/0.25).

The Team's interest in retaining information at both riparian and catchment scales led to the following compromises:

- Use the riparian area metrics for SWQ land cover, instead of full planning unit, although they are highly correlated;
- Retain wells, surface and underground mining, and impervious surface for the entire catchment.

Suggestions from the experts:

- Create a "Riparian Area" metric in the Streams Water Quality Index (SWQ), because the amount of riparian area is an important water quality indicator. Response: The Team has essentially captured this with the NatCoverRip (Riparian Natural Cover) metric since most of the riparian area is forested.
- Redefine the headwaters metric, since most of the catchments currently contain headwaters, which the Team has defined as size class 1a and 1b streams. They should be ephemeral or intermittent streams of first order or lower, with a drainage area of ~2000 acres. Response: The Team checked the streams dataset, and agreed that only size class 1a should be used to define headwaters.

Questions from the experts:

- How were the impervious surface scores computed? Response: The Team used Mike Strager's 2009 land cover data, and the NLCD 2006 impervious cover data. Experts suggested looking at impervious scores of different land uses, and assigning impervious equivalencies to the Strager data to see how they look. Response: the Team researched impervious surface calculation

methodologies and determined that using the NLCD 2006 impervious cover data was the most accurate method for determining average percent imperviousness.

- Is WV's impaired streams data based on more than one dataset? Response: The Team used the DEP's 303(d), TMDL, and AMD streams data.

Other recommendations and summary points:

- Several of the metrics are, in the Experts' opinion, important enough that they should determine the entire index: pH, imperviousness, surface mines, and specific conductivity for the SWQ index. If any two of them are poor, the SWQ index should be poor; if any two of them are fair, the entire index should be fair. This idea is further elaborated in the Categorization section below.
- Perhaps the GLIMPSS score should not be the metric used to indicate good water quality in regression models. The team should determine whether there are high GLIMPSS scores in poor quality areas to ensure that GLIMPSS scores do correspond to water quality parameters measured in these watersheds.
- Double check the impervious thresholds because they are very low. Check the Potomac ELOHA study for their treatment of impervious surface. Response: the Team checked the imperviousness threshold numbers, and they are correct, as determined by the method of using reference and stressed catchments.
- If the impervious surface thresholds come from the Reference Streams catchments, then use the Tier 1 streams to determine the Very Good threshold, and the Tier 2 streams to determine the Good threshold. Response: to keep the imperviousness metric consistent with other metrics, this suggestion was not incorporated. Since reference and stressed results were so low, thresholds from the literature were used instead.
- Some of the experts believed that urban development has the same effective impact as surface mining, and so perhaps should have the same thresholds. Response: the objective method of threshold calculation based on stressed and reference catchments worked well for the development metric, and was therefore used. Thresholds for surface mining were adopted from expert's suggestions during the workshop and a review of available literature.

Streams Water Quantity Index. Experts recommended that the Large Quantity Users (LQU) on small streams metric should be weighted as high as 2, since water is often consumed and not returned. Response: The Team increased the weight of this metric to 2.

Only large quantity users with permits are captured by the LQU metric, and gas drilling is not. This is because the water is often withdrawn in planning units other than where the well is located. The Team and Experts are not aware of any data for discharge to show what is coming in to the streams, to balance what is withdrawn.

Streams Hydrologic Connectivity Index. There was a question from the experts regarding the purpose of the Power Plants metric. Response: It indicates a temperature barrier to aquatic life. One expert observed that, technically, the water should be cooled before being released into the stream, but some plants like Mt. Storm are discharging 98 degree water. Another commented that the high temperature is getting dissipated quickly with the rest of the stream and it doesn't seem like a thermal barrier should last long.

The experts recommended increasing the weight of road/rail and culverts metrics. Response: the Team incorporated this recommendation.

Streams Biodiversity Index. The Team requested expert opinion on whether a planning unit with a large number of rare species should automatically be put into a higher category as a priority for protection, even if its score is "Fair" or "Good." The Experts did not venture an opinion on this.

The Experts recommended using the maximum number of taxa vs. median number taxa to indicate macroinvertebrate diversity. Response: the Team incorporated this recommendation.

Streams Riparian Habitat Index. The Experts asked for a definition of riparian area. Response: It is based on TNC's Active River Area, with a 120-m buffer on the NHD 24k streams, and encompasses the floodplain and riparian wetlands.

There was extensive discussion if the Team should use Emily Bernhardt's published thresholds for surface/legacy mining. It was agreed that they are conservative numbers determined in the southern coalfields. In contrast, data from Todd Petty covers the entire state, and is likely more relevant to this project.

Other recommendations:

- Increase the weights of road/rail and active surface mining in the riparian area. Response: The Team increased the weight of surface mining to 2 and road/rail to 1.5.
- One expert suggested that development and active surface mining are of greater importance in the riparian area than roads, so their weights should be higher. Response: the Team incorporated these recommendations.

Wetlands Water Quality Index. Question from the Experts: Should the wetland water quality metrics be the same as those for streams? Response: The Team is trying to capture more of the wetland functions: a wetland may be of "poor" quality but still serve to moderate flood events. Likewise, poor quality of water entering a wetland may make its functions even more valuable for water purification. It was agreed that the presence of any wetlands is good, and that even poor quality may be worth protection and/or restoration.

Uplands Landscape. The major issue the Team and the Experts noted with the Uplands model results was that there are few if any HUC12 planning units that fall into the "Poor" or "Very Good" categories.

The Experts had several observations:

- It is possible that these three watersheds really do have little variation among the planning units. It would be interesting to analyze a watershed containing a heavily impacted area, such as Wheeling, as well as a watershed expected to be pristine, to see if some of those planning units are ranked as Poor or Very Good by the objective method. Response: The Team analyzed the Monongahela watershed and presented the results on Day 2.
- Depending on whether the goal is to assess current watershed condition or restoration potential, land uses could be weighted differently. From a hydrology perspective, grazed lands are better than cropped areas, and both are better than development because they are restorable. Response:

Since the SWQ index assesses the current condition of the watershed, weights for grazed, agricultural, and developed areas in the riparian area were kept at 1. The web tool will include these land uses as overlays so users can evaluate restoration potential based on local conditions.

- Habitat fragmentation by roads is potentially a more complicated issue than represented by road presence/absence, and road buffer acreage (i.e. road classes) instead of mileage could be used to represent this. Response: The Team considered this during the assessment methodology development. It is already captured in the Forest Size metric, which uses hierarchical road buffers as forest fragmentors. Another factor is that road size effects are often taxon-specific: birds, mammals, and seeds may travel across highways, where amphibians and insects may not.
- Gravel roads have different impacts depending on their purpose, location, and level of use, so their incorporation into the analysis is potentially very complex. Response: Roads are not separated by surface type because of the complexity of the issue and uncertainty of effects on the metrics.
- Gas wells or surface mines are often located on legacy mine lands: should this be reflected in the analysis? Re-mining often creates fresh impacts, and revegetated mines may no longer impact streams directly. Response: The Team has addressed this by separating surface and legacy mining in the habitat metrics, and combining them in the water quality metrics.
- Experts noted that GAP 3 lands may still be subject to resource extraction, and GAP 2 lands may still experience the effects of previous land uses.

Uplands Habitat Connectivity and Uplands Habitat Quality Indices. Because land conversion is such a large driver in these indices, the Team and Experts discussed the idea of "killer metrics": the situation in which a catchment contains so much development or surface mining that it is inappropriate for either conservation or restoration, regardless of its other attributes. This idea is further elaborated in the discussion of Categorization and Thresholds below.

Uplands Biodiversity Index. Concerns with the Biodiversity Index were reiterated: it emphasizes rare species, and the available data on rare and invasive species are spatially biased and do not indicate areas that were sampled but no targets were found. Response: Unfortunately, there are no available alternatives.

The Percent Basal Area Loss metric is weighted very high, and in some cases appears to drive the results of the biodiversity index. Positive attributes of this metric are that the results cover a wide range of values and are appropriate for the watershed scale (unlike some datasets that are county-wide). The predicted basal area loss metric might also be useful in deciding where to undertake treatment or restoration. The experts suggested retaining this metric if the Team is confident in the models used to generate the predictions. Response: The team will review the literature on the National Insect and Disease Risk Maps.

Protected Lands Index. The Team requested expert opinion on how to deal with the Protected Lands Index for each landscape. Most planning units contain no protected lands in categories GAP 1, 2 and 3, bringing down the overall model scores. Should this index be removed from the analysis?

Opinions varied regarding retention of the Protected Lands Index, but it was generally agreed that this information is most important for establishing priorities for conservation and restoration, so it depends upon whether the web tool will be used for condition assessment or for prioritization. Areas adjacent to protected lands are especially important in this context. Ideally a metric might be a cost-weighted distance from the planning unit to the nearest protected land, but this would be very complex because many

different types of obstacles might lie between them; i.e., an interstate highway vs. a gravel road. Response: Because of the complexity and uncertainty of distance effects from different land uses, this suggestion has not been incorporated into the model.

One suggestion was to use the Protected Lands layer as an overlay to the analysis, rather than incorporating it. This would allow identification of adjacent areas to be targeted for protection or restoration. The condition of the protected lands, especially GAP 1 or 2, would also be an indication of the potential quality to which newly acquired lands could be restored. Response: The web tool will include protected lands as an overlay to allow users to evaluate this factor for their uses.

Another suggestion was to incorporate a presence/absence type metric to indicate protected lands and those immediately adjacent so that they receive a slightly higher condition score. Response: this is how the model is currently set up.

Metric and Index Categorization and Thresholds

The objective results for the three watersheds show little variation; most of the HUC12s or catchments were in the "Fair" or "Good" categories. An expert agreed that seeing only two categories displayed on a map suggests that the analysis is not sufficiently refined. It was also suggested that the many metrics/indices were cancelling each other out, especially in the case of the HUC12s. Another possibility is that the planning units in these three watersheds really are "Fair" and "Good" compared with all the others in the state. Experts suggested looking at a watershed that is expected to be highly impacted, such as in the Wheeling area, to see if any of the planning units fall into the "Poor" category. Response: As summarized below, the Team re-analyzed the more heavily impacted Monongahela watershed with the objective method and found more variability in this watershed.

It was suggested that the "Poor" results category should be renamed to impartially reflect the low numerical results, without implying that an area is unsuitable for restoration, since some organizations may specifically target highly impacted areas such as AMD-impaired streams for restoration. Suggestions for renaming the category included:

- Changing Fair and Poor to Impaired and Severely Impaired or Degraded and Severely Degraded
- Changing Poor to Restorable at Cost
- Adding a "Not Recoverable" category for the lowest-scoring planning units, which would include intensely urban areas, to distinguish from those areas that could be lifted from Poor to Fair for ecological mitigation credits

Experts did not recommend adding any additional categories, although there may be a way to flag individual metrics (or otherwise make data available to users) that either indicate that a planning unit is not recoverable, or that if improved might make it a target for restoration. Any terminology should be explicitly and prominently defined in the documentation of the interactive web tool or in the watershed assessments. Response: the Team decided to keep the terminology as is with explicit definitions in any documentation.

As an extension to the discussion of relative metric weights, the Team and Experts began developing the idea of "killer metrics:" those metrics that either alone or in combination may have sufficient negative

impacts on a planning unit that their value determines the value of the entire index. As an example, the Streams Water Quality index contained four metrics that the Experts believed were sufficiently indicative of stream health that if two or more had "Fair" or "Poor" scores, the entire water quality index should be rated as Poor, overriding other factors: Median pH, Median Specific Conductivity, Impervious Surface, and Surface Mining. Metrics for other indices the Experts identified as "killer metrics" included:

Streams Water Quantity: Impervious surface
Streams Riparian Habitat: Development and Active surface mining
Wetlands Wetland Habitat: Development and Active surface mining
Uplands Habitat Connectivity: Development and Active surface mining
Uplands Habitat Quality: Development and Active surface mining

Workshop Day 2
October 11, 2012

Presentation Summary

The second day of the workshop opened with an overview of the Little Kanawha watershed results and a preliminary analysis of the Monongahela watershed to give an example of results obtained in a more impacted watershed. This was followed by more general discussion of the Wetlands and Uplands landscapes. The floor was then opened to the experts to give their opinions on the features and content of the interactive web tool that will be constructed to present the watershed assessments to various users.

Overview of Little Kanawha Watershed

Diane Packett, TNC

Habitat fragmentation by grazing, development, and roads is more prominent than in the other watersheds. There is very little surface or underground mining, although there are many wells. Most of the major tributaries of the Little Kanawha River are impaired, and biological contaminants/fecal coliform and iron are the predominant impairments. There are GAP 1, 2, and 3 protected lands in the watershed, including several WMAs, two state parks, and one TNC preserve. There was one irregularity on the display map: the absence of the Wells locks & dam; this was a data processing error and has been corrected.

Comments: Experts noted that there are several pollution issues in the Little Kanawha River, and DEP will be starting TMDLs in 2014. Sedimentation from well pads and access roads is an issue due to a shortage of well inspectors and lack of training in sedimentation. They also noted the presence of federally endangered mussels in the Little Kanawha, and speculated on the location of a new DNR wetland conservation area, managed by Ducks Unlimited, next to a Wal-Mart.

Preliminary Analysis, Monongahela Watershed

Misty Downing, TNC

In the previous day's session, it was speculated that the reason that the objective method shows little variability among HUC12 watersheds is that in fact these particular watersheds contain little variability.

Experts had suggested running the analysis on a watershed containing an area that is likely to be heavily impacted to determine if appropriate HUC12 watersheds are categorized as poor. Accordingly, Misty Downing subjected the Monongahela watershed to the objective analysis, and found that there is, in fact, greater variability among planning units (from Poor to Very Good) in this more heavily impacted watershed, at both the HUC12 and catchment levels.

Wetlands and Landscape

Ruth Thornton, TNC

The Team requested expert advice on dealing with a troublesome issue in the Wetlands model: currently, having no mapped wetlands in a planning unit places it in the "Poor" category, although there may be hydric soils indicative of past or potential future wetlands. The Wetlands Hydrology index, an indicator of wetland "potential," incorporates the presence of floodplain and hydric soils. However, hydric soils are inconsistently mapped across the state, and where they are not mapped, the "null" values skew the results.

Recommendations:

- The Team and the Experts were most comfortable with the idea of removing from the wetlands analysis those catchments that do not have an NWI wetland, floodplain, or hydric soils, which indicates that no restoration potential exists. For the HUC12 analysis, it may be advisable to set a "minimum area requirement" so that HUC12s with very few wetland indicators are classified as "null" instead of "poor". Response: The Team incorporated this suggestion by removing planning units without wetlands, floodplains, or hydric soils from the wetlands analysis.
- It may also be possible to "extrapolate" the presence of hydric soils: depending on the stream gradient, there will be a certain percentage of the floodplain that will be hydric. Response: This would likely be very time intensive, and is impractical since soil map units are often inconsistent between counties. There is a DNR project in progress to develop a tool to predict wetland potential; this and other datasets could be incorporated into the model in the future as improved data become available.

Interactive Web Mapping Tool

Ruth Thornton, TNC

It was agreed that the web tool will be used by a variety of groups for different purposes, and it would be desirable to provide a User's Guide with tutorials for different scenarios and levels of information needed: a watershed group writing a grant, in lieu fee mitigation projects, USACE projects, etc. It will be important for users to identify their priorities, and the User's Guide could direct users to the Objective or Relative ranking system that would most suit their purposes. Response: the Team agrees with this recommendation and will develop appropriate tutorials.

Types of maps/processes that could be included in the web tool:

- A step-by-step process for those seeking a protection or restoration site with varying criteria;

- A place-based results map similar to the EPA's Surf Your Watershed tool, in which a user might click on a place in a state map to view HUC12 or catchment results and attributes. This may keep less technically-oriented users engaged;
- A 'hot spots' issues map that someone with funding for particular projects can use to locate sites.

Suggestions for features to include in the tool:

- An example of a use scenario, taking the user from large scale to small – HUC12 to catchment
- The ability to save the current search/place within the tool so that the user can resume later
- An ID tool to display the attributes of selected features
- The ability to select desired layers to view and features displayed for the base layer
- Data that was dropped from the analysis but which users could display as overlays if desired.

Response: the Team will work with the web tool developer to incorporate as many of these suggestions as can be accommodated.

Next Steps

Prior to the second expert workshop, the Team will incorporate the metric thresholds and weighting recommendations, including the "killer metrics" and wetland hydrology, into the objective method and re-run the analyses for the Gauley, Little Kanawha, and Upper Guyandotte watersheds. These results will be presented at the second expert workshop with the preliminary Consolidated Analysis results. The Team will also seek expert input on potential strategies for addressing issues identified in the watersheds.

Meeting Attendees

Name	Affiliation	Email	Telephone
Keith Fisher	TNC	Keith_fisher@tnc.org	304-637-0160
Ruth Thornton	TNC	rthornton@tnc.org	304-637-0160
Diane Packett	TNC	dpackett@tnc.org	304-637-0160
Misty Downing	TNC	mdowning@tnc.org	304-637-0160
Amy Cimarolli	TNC	acimarolli@tnc.org	304-637-0160
Rebecca Albert	USACE	Rebecca.M.Albert@usace.army.mil	304-399-5143
Charlie Vannatter	Triad Engineering	cdvanatter@google.com	804-451-8688
Nick Murray	WVDEP	Nick.s.murray@wv.gov	304-926-0499 (1034)
Danny Bennett	WVDNR	Danny.a.bennett@wv.gov	304-637-0245
Mike Whitman	WVDEP	Michael.j.whitman@wv.gov	304-926-0499 (1088)
Brady Gutta	WVWRI	jbgutta@mail.wvu.edu	304-293-7002
Braven Beaty	TNC	bbeaty@tnc.org	
R. Gus Drum	USACE	Richard.g.drum@usace.army.mil	304-399-5851
Dan Bailey	USACE	Daniel.s.bailey@usace.army.mil	304-399-5824